

# Status of the River Frog, *Rana heckscheri* (Anura: Ranidae), in North Carolina

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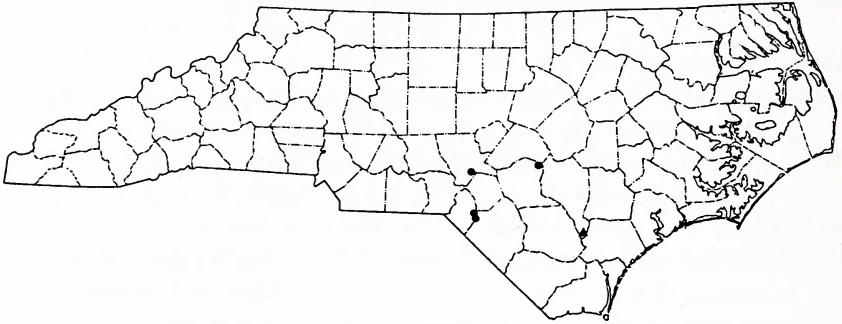
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**ABSTRACT**--The river frog (*Rana heckscheri*), a large ranid occurring in aquatic and riparian habitats in the southeastern United States, reaches the northern edge of its range in southeastern North Carolina, where it has been recorded historically from a few scattered localities in the Lumber and Cape Fear river systems. Currently listed by the state as a species of Special Concern, *R. heckscheri* was last documented from North Carolina in 1975. A survey was undertaken to determine the frog's status in the state. Considerable field work has failed to yield any current evidence of its existence in North Carolina, and it appears likely that the species no longer occurs there. Reasons for its apparent disappearance are unknown.

The river frog (*Rana heckscheri*) is a large ranid occurring in association with blackwater river habitats from southern Mississippi to southeastern North Carolina (Sanders 1984, Conant and Collins 1991). The species is known in North Carolina from only a few scattered localities in the Lumber and Cape Fear river systems (Fig. 1). Little has been published on *R. heckscheri* in North Carolina. Its occurrence in the state was first suggested by Brimley (1944), who listed it among the state's fauna with some doubt on the basis of a single specimen of a frog found dead at a heron rookery at Battery Island in Brunswick County on 13 June 1938. His tentative identification was apparently based solely on the frog's dark ventral coloration, and his brother, H. H. Brimley (1938), remarked that "it was a noticeably black specimen, with very definite markings showing on the inside of the thighs, so we brought it back . . . to identify . . . but it turned out to be nothing more than a common bull frog!" DePoe and Funderburg (1959) and Simmons and Hardy (1959) discounted that specimen as being *R. heckscheri*, probably rightfully so, as the specimen apparently was not retained and cannot be verified.

DePoe and Funderburg (1959) reported a specimen of *R. heckscheri* from Greenfield Lake in New Hanover County, collected 10 May 1948, but that specimen (Cornell University 5496) was later identified as *R. catesbeiana* (Sanders 1984).

Fig. 1. Historical distribution of *Rana heckscheri* in North Carolina. Dots represent localities documented by specimens in curated collections. The triangle represents an approximate locality supported by a specimen.



The first legitimate records of the river frog in North Carolina were reported by DePoe and Funderburg (1959) and Simmons and Hardy (1959). The apparent earliest specimen was collected as a tadpole by a University of North Carolina student in March, 1957, at an imprecise locality on the Black River in Sampson County, and kept in an aquarium at the University until it transformed (DePoe and Funderburg 1959). It was later donated to the North Carolina State Museum (NCSM 14610) by W. L. Engels. Simmons and Hardy (1959:37) reported collecting a series of *R. heckscheri* tadpoles on 21 March and additional specimens on 12 April 1958 (a date of 12 March was also reported later in the same paper, but appears to be an erroneous reference to 21 March) from "a gravel pit pond" near Maxton in Robeson County, "located at the intersection of State Highway 71 and the Lumbar [sic.] River." They further reported that "a local farmer, obviously familiar with the distinctive tadpoles, has been aware of their occurrence [sic.] in the Maxton ponds for at least fifteen years." It is not known what became of the specimens Simmons and Hardy collected. No repository was listed in the paper, and it is possible that the specimens were not saved. A photograph of one of the tadpoles was included; it appears to be the only published photograph of a river frog tadpole from North Carolina. A currently existing small, shallow pond near the west bank of the Lumber River just southwest of the NC 71 bridge is probably the site referred to, but no *R. heckscheri* have been found there in recent years. The locality for four specimens in the U.S. National Museum (USNM 144367-144370), collected by Hardy 30 May-1 June 1960, was given as only "Robeson-Scotland Co. line, Air Base," and may or may not

refer to the same site. The air base (now Laurinburg-Maxton Airport) actually lies in Scotland County ca. 2 air miles WNW of the NC 71 bridge.

On 7 August 1958, C. E. DePoe collected a single juvenile *R. heckscheri* (NCSM 7004) at Rhodes Pond, a large cypress lake located 1.5 air miles NE of Godwin in Cumberland County (DePoe and Funderburg 1959). A specimen in the American Museum of Natural History (AMNH 22433) is reported as having been collected at Southern Pines in Moore County, with no further data.

DePoe and Funderburg (1959) reported several additional specimens found among frogs brought to Carolina Biological Supply Company by commercial collectors, believed to have been collected "either in the Cape Fear or Pee Dee river drainages in southern North Carolina." Only one of these has been confirmed as *R. heckscheri*, a specimen (NCSM 7005) collected ca. mid June 1958 from an undetermined locality.

The remaining records from the state have come from a series of borrow pit ponds along the Lumber River near the SR 1433 bridge at the Scotland-Robeson County line, 5 air miles S of Wagram; and from along the Lumber River between that site and the NC 71 bridge. Voucher specimens from that locality in the collections of the North Carolina State Museum of Natural Sciences are as follows:

7 Feb. 1965: Series of 17 larvae seined from borrow pit pond by W. M. Palmer and J. R. Paul (NCSM 3741).

16 April 1967: Five of six adults taken from borrow pit pond by J. R. Bailey et al. (NCSM 32080-32084, formerly DU A6819). Bailey (personal field notes) noted "no significant difference in habit or habitat . . . from bullfrogs taken there at same time."

23 May 1968: Series of nine adults collected by floating the Lumber River from 8-12 pm "from first half to 2/3 of distance" between the SR 1433 and NC 71 bridges by J. R. Bailey et al. (NCSM 9790 and 32085-32092, formerly DU A9349). Bailey (personal notes) noted that 40 bullfrogs were also taken along the same stretch, but that only bullfrogs were taken upstream from the SR 1433 bridge.

6 Feb. 1971: Series of larvae seined from borrow pit pond by W. M. Palmer and D. L. Stephan [NCSM 10058 (5 larvae) and NCSM 26534 (10 larvae)].

21 Oct. 1973: Series of 30 larvae collected from borrow pit pond by A. L. Braswell and D. L. Stephan (NCSM 12895).

12 July 1975: Adult female taken beside borrow pit pond by A. L. Braswell, D.L. Stephan, and J. H. Reynolds (NCSM 15659). This is the last known specimen from the state. Its photograph appears in Martof et al. (1980) and in a popular article by Dopyera (1995).

Little else has been published on *R. heckscheri* in North Carolina, and little is known about its natural history in the state. Neither eggs nor calling adults have been reported from the state. Martof et al. (1980) provided a brief descriptive account of the species in the Carolinas and the aforementioned photograph. Stephan (1985) and Beane (1993a) wrote popular articles, and Stephan (1989) provided a brief account of the frog's status in the state. In 1990 it was granted protection as a species of Special Concern under the North Carolina Endangered and Threatened Wildlife Law (G.S. 113-331 to 113-337). Beane (1993b) provided a more detailed summary of its status in the state.

Short accounts of *R. heckscheri* in other states and general information on the species may be found in Wright (1924, 1932), Allen (1938), Carr (1940), Wright and Wright (1949), Mount (1975), Sanders (1984), Behler and King (1985), Ashton and Ashton (1988), and Conant and Collins (1991). Recordings of the breeding call are provided by Bogert (1958), Anon. (1982), and Elliott (1992).

A survey was undertaken to determine the current distribution of the river frog in North Carolina (if indeed it still occurred in the state), to evaluate the status of any populations located, to learn more about the biology and habitat requirements of the species, to identify the level of protection it should be afforded, and to outline any conservation measures that might be justified.

## METHODS

Efforts were made to locate all museum specimens and literature records of the river frog in North Carolina. Field survey work was centered around the vicinity of these records, as well as other potential sites. Sites investigated included many areas along the Lumber, South, Black, Northeast Cape Fear, Cape Fear, Waccamaw, and Lockwood Folly rivers and their larger tributary streams and swamps.

Field work for this survey was conducted between spring 1987 and fall 1996, and is ongoing; however, most of the work was conducted between April 1992 and September 1993. During 1992-1993 over 1,500 man-hours were devoted to field work and travel for the project, and a comparable amount of time was devoted to office work. Over 10,600 miles of travel were logged in that time period. The area surveyed included portions of Robeson, Scotland, Columbus, Bladen, Sampson, Cumberland, Pender, Brunswick, Hoke, Duplin, New Hanover, Moore, Richmond, and Harnett counties, North Carolina; and Horry County, South Carolina. Beane (1993b) provided a map and list of specific localities visited during 1992-1993 along with dates and survey methods used at each site.

Survey techniques included navigating rivers and other bodies of water by canoe or johnboat during the day to search for suitable habitat, adult frogs, or schools of tadpoles; floating the same areas by night with flashlights and head-

lamps in search of adult frogs; walking or wading potential habitat at night with lights; visually scanning for the large and conspicuous tadpoles at bridge crossings or other sites with good visibility; seining and dipnetting for tadpoles; slowly driving and walking roads through suitable habitats--particularly bridge crossings--on rainy (and non-rainy) nights; and listening for calling adults at potential sites by day and night.

Posters depicting a drawing of the river frog's distinctive tadpole were widely distributed in the southeastern part of the state. Biologists and outdoor enthusiasts residing in, collecting in, or frequenting areas within the frog's range were encouraged to report any suspected sightings. Local residents were often questioned when encountered in the field, and many were shown a large preserved tadpole and photographs of adult frogs. Several articles featuring the river frog project appeared in regional newspapers, and the survey was advertised in several issues of the North Carolina Herpetological Society newsletter. Several public field trips to search for river frogs were organized through the North Carolina State Museum, and several public talks on the project were presented, using slides, photographs, call tapes, preserved specimens, field guides, and a live adult frog from Florida as educational tools. Participants in the field work were familiarized with river frog identification.

## RESULTS

This survey revealed no current evidence of river frogs anywhere in North Carolina. All 26 other anuran species known to share the potential range of the river frog (NCSM files, Conant and Collins 1991) were encountered in the state during the survey, most of them in relative abundance. The most productive methods for locating ranids were nocturnal searches with lights, conducted either by canoe or on foot, and driving roads on rainy nights. All other *Rana* (*R. catesbeiana*, *R. clamitans*, *R. utricularia*, *R. palustris*, *R. virgatipes*) with similar habits and utilizing habitats similar to those of the river frog were frequently encountered. River frogs were encountered with little difficulty in Franklin, Liberty, and Wakulla counties, Florida; Charlton, Clinch, and Ware counties, Georgia; and Hampton, Jasper, and Sumter counties, South Carolina during the time of the survey.

No reports of river frog encounters in North Carolina were received during the time of the survey. Only two plausible and previously undocumented reports of earlier sightings were received, and both may have occurred prior to the last documented sighting in 1975. J. H. Carter III, an environmental consultant and experienced field biologist with herpetological expertise, reported (personal communication) having seen what he believed to be an adult river frog in a large lake on the campus of St. Andrews Presbyterian College in Laurinburg, Scotland County. (Visits to this site during the day and again at night during a thunder shower in late June of 1993 yielded no evidence of the species.) David

Scott of Fair Bluff, an active conservationist and founding member of the Lumber River Basin Committee, also reported (personal communication) having taken what he believed to be an adult river frog while frog gigging on the Lumber River in the vicinity of Fair Bluff along the Columbus-Robeson County line. Neither individual could recall the date of the sightings, but both estimated them to have been in the early to mid-1970s. Unfortunately, neither of these sightings can be verified because of the similarities between adult river frogs and some bullfrogs.

Only three responses to the many "wanted" posters distributed were received, all of them false leads. Most local persons, when shown preserved tadpoles, had obviously never encountered them before.

### DISCUSSION

The results of this survey suggest that the river frog no longer occurs in North Carolina. However, such a conclusive statement is difficult to make with absolute confidence. The rather large amount of potential habitat present in the state, and the limited scope of the current work, make it possible to envision how populations of this frog could escape detection. Beane (1993b) remarked that if the species still occurred in the state, it probably deserved Endangered status, but recommended that it remain Special Concern since its occurrence had not been verified.

The status and range of the river frog in South Carolina are not well known. Until recently, the northernmost known populations from that state were from the vicinity of Poinsett State Park in Sumter County, in the Santee drainage (Sanders 1984), and the species still appears common at that site (personal observation). In 1996, *R. heckscheri* was first documented from the Pee Dee drainage in South Carolina by Michael E. Dorcas et al. from two sites on the "Woodbury Tract," a 20,000-acre parcel of land situated at the confluence of the Great Pee Dee and Little Pee Dee rivers, ca. 16 air miles SSE of Brittons Neck in Marion County. River frogs were heard calling from two sites on that tract on 6 April and 18 April 1996. Although no specimens were collected or seen, a recording was made of three individuals calling on 18 April. The tape was verified by J. Whitfield Gibbons and is on file at the Savannah River Ecology Laboratory (Michael E. Dorcas and Katie Distler, personal communication). The species has yet to be reported from the Waccamaw drainage in either North or South Carolina. It is possible that the lack of records from the northern Coastal Plain of South Carolina reflect a lack of collecting efforts in that region rather than a genuine absence, and more field work is needed in that area to determine whether any currently or previously existing North Carolina populations should be regarded as peripheral or disjunct.

Much attention has been devoted in recent years to the apparent global decline in many amphibian populations (Barinaga 1990; Blaustein and Wake 1990; Phillips 1990, 1995; Wyman 1990; Livermore 1992). No single cause explains all of these widespread and often alarming disappearances, and there is general agreement that a combination of factors is probably responsible. Although habitat loss has been associated with the decline of many species, this does not seem to be the case with the river frog in North Carolina; suitable habitat appears to be plentiful. The fact that oxbow lakes on blackwater rivers are rarer in North Carolina (Schafale and Weakley 1990) than in areas further south, might represent a limit of prime breeding habitat for river frogs. However, the species breeds in other habitats as well, and places where it has been taken historically in the state do not seem unique in any way that is readily observable.

Reasons for the apparent disappearance of the river frog from sites where it once occurred are unknown and must remain speculative. Factors limiting the distribution of the species are poorly known. The frog was apparently never common or widespread in North Carolina, and small, scattered populations of any species are usually more vulnerable to extinction than are large, widespread ones. Species at the edge of their range likewise tend to be susceptible. Some possible explanations for the apparent disappearance of *R. heckscheri* from North Carolina, all of them speculative, include a number of diverse factors:

- 1) Frog gigging or spearing still appears to be a popular sport in some parts of southeastern North Carolina, although many persons encountered during the survey spoke of its being more widely practiced (as well as more productive) in past years. The rather unwary adult river frogs (Carr 1940, Wright and Wright 1949, Mount 1975) probably make easier targets for frog hunters than any other *Rana* species. It is conceivable that intensive take by humans in an area could seriously impact or eventually eliminate populations, especially those that were relatively small.

- 2) Other ranids surely compete with river frogs, both as larvae and adults, and the niche of the bullfrog in particular seems to overlap that of the river frog rather broadly (Carr 1940, Wright and Wright 1949). Although the two have been taken sympatrically at numerous sites, the highly adaptable bullfrog is probably a better competitor in certain, if not most, situations, and it is possible that a change in environmental quality or in some particular selective pressure could offer bullfrogs an advantage leading to river frog extirpation.

- 3) A general overall decline in environmental quality could be responsible for the river frog's decline in North Carolina. It was beyond the scope of this survey to delineate the exact causes or effects of any environmental degradation that may have occurred over the past several decades. Although precise long-term data are difficult to obtain, it seems almost certain that some declines in water quality have occurred in the state's blackwater rivers. Most fishermen and other local residents encountered during the course of field work seemed of the opin-

ion that fishing and frogging had declined, and that various species of wildlife were not as frequently observed as in past years. While frogs were generally found to be common during this survey, there were occasions when far fewer were observed than expected. As an example, during four hours of night canoeing on a stretch of the Northeast Cape Fear River in Duplin County on 6 September 1992, a total of only three anurans were observed. Little is known about the sensitivity of the river frog to environmental changes.

Finally, Pechmann et al. (1991) pointed out the difficulties sometimes involved in distinguishing true amphibian declines from natural population fluctuations, and Hairston and Wiley (1993) emphasized the value of long-term studies in determining whether supposed amphibian declines were genuine. While the apparent absence of *R. heckscheri* in North Carolina could represent a natural fluctuation, the lack of a single record in more than 22 years suggests otherwise. Still, conclusive documentation of extinction can be difficult for any organism, and more field work is needed to determine the river frog's true status at the northern edge of its range. It is hoped that biologists working in southeastern North Carolina will make every effort to collect and report all possible evidence of *R. heckscheri* in the state.

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